

## Chapter 9 – Design Guides

### 9.4 COMMISSIONING GUIDE

#### A. GENERAL

1. Building commissioning is a process to improve quality and functional reliability of active and passive systems within a project's budget. Although there are many ways to commission projects, it is best to start the process during the programming phase and continue it through the construction phase and initial occupancy. Commissioning provides building maintenance procedures and monitoring system performance for improved operation and sets the baseline for building re-commissioning. Commissioning is an option for clients on most projects. Commissioning is required if the client has requested that the building achieve LEED certification..
2. The intent of commissioning is to improve indoor air quality, increase equipment reliability, increase energy efficiency and ensure that the client agency's approved design intent and operational needs have been met.
3. The commissioning process usually will involve a commissioning authority and/or agent, the Design Team, the Engineer-In-Charge and facility maintenance staff. The expectation is that all who take part will benefit from the operational expertise of the commissioning agent, especially if there are problems at initial start-up.

#### B. REQUIRED COMMISSIONING

Commissioning of building energy systems is a requirement in the LEED rating system. LEED includes two types of commissioning. The first is a required level (prerequisite) and the other is for "enhanced" commissioning.

1. LEED Fundamental Commissioning. The mandates include:
  - a. Engaging a commissioning team that does not include individuals directly responsible for project design or construction management.
  - b. Develop and utilize a commissioning plan.
  - c. Reviewing the design intent and the Basis of Design (BoD) documentation.
  - d. Incorporate commissioning requirements into the construction documents.
  - e. Verify installation, functional performance, training and operation and maintenance documentation.
  - f. Complete a commissioning report.
2. LEED Enhanced Commissioning requires the following additional commissioning tasks:

- a. A commissioning authority independent of the Design Team shall conduct a review of the design prior to the construction documents phase.
- b. An independent commissioning authority shall conduct a review of the construction documents near completion of the construction document development and prior to issuing the contract documents for construction.
- c. An independent commissioning authority shall review the Contractor submittals relative to systems being commissioned.
- d. Provide the Client Agency with a single manual that contains the information required for re-commissioning building systems.
- e. Have a contract in place to review building operation with O&M staff, including a plan for resolution of outstanding commissioning-related issues within one year after construction completion date.

### **C. NON-REQUIRED COMMISSIONING**

Although Executive Order 111, (which prescribed commissioning for larger state buildings), has been repealed, designers should strive to incorporate the principles of green design. This may be done by adapting LEED prerequisites and credits to their project when possible, even if certification is not pursued or applicable. Commissioning will generally produce the biggest benefit to projects that include mechanical equipment. For smaller projects the scope of the commissioning may be reduced and a minimal commissioning plan adopted. Such non-LEED commissioning shall remain an optional service confirmed with the client early in the programming and design process.

### **D. Code Required Commissioning**

1. Parts 909.3, F909.3 and M513.3 of the NYSUFP&BC require special inspections for smoke control systems and that these systems be commissioned. The requirements for the commissioning are that it be “in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved”. Projects which include smoke control systems must include commissioning these systems at a minimum.

### **E. Commissioning Activities**

1. During design the commissioning team is expected to bring operational expertise to the project. There are several ways this will benefit the project:
  - a. Development and approval of the Basis of Design (BoD): The BoD is a written description outlining how systems will operate. The Client Agency or their representatives should set the direction for the BoD. It may be modified as the design is developed but it should be included in the Program Report so it is subject to the client’s approval. The BoD becomes a training and diagnostic tool, is included in the

- commissioning report and may be used to evaluate the success of the project design and construction.
- b.** Selection of the most appropriate building systems (mechanical, electrical, controls, security, etc.): The process should include the facility maintenance staff, facility planner, Designers, Engineer(s)–In-Charge and commissioning agent(s). This should produce a consensus of what system is best for the project and improve client satisfaction and acceptance.
  - c.** Improved access to equipment and design for equipment maintenance: The commissioning agent’s operational expertise and maintenance staff’s involvement should help prevent poor equipment layout.
  - d.** Creation of the commissioning specification: The specification will serve as a roadmap for all the commissioning tasks.
  - e.** Quality facility staff training: Improved training will make sure that the facility is capable of operating the equipment efficiently and should prevent operation that could void equipment warranties.
  - f.** Improved testing procedures and problem diagnosis: The commissioning process should ensure that all the equipment is correctly installed and controlled. Although not all problems will be eliminated, the unsolved problems will be documented.
  - g.** Complete maintenance manuals and as-built drawings.
- 2.** During the project the commissioning process should be designed to promote an installation that is in compliance with the construction documents. This will be achieved in several ways:
- a.** Prefunctional testing or Point to Point (PTP) checks that wiring has been done correctly.
    - 1)** Review of Contractor’s certificate of readiness.
    - 2)** Documents equipment brands and model numbers.
    - 3)** Insures that all the equipment and controls in the construction documents have been provided.
    - 4)** Check sensor calibration; confirm valve and damper functionality.
  - b.** Testing and balancing (TAB).
    - 1)** Checks flows on water and air distribution systems.
  - c.** Functional Performance Testing (FPT):
    - 1)** Spot check (minimum of 10% of the TAB).
    - 2)** Dynamic Testing:
      - a)** Modulation in full range of equipment capacity.
      - b)** Power failure/power down.
      - c)** Backup upon failure.
    - 3)** System and intersystem testing:
      - a)** Alarms.
    - 4)** Control testing:
      - a)** Start-up, shutdown, power down, manual operation, unoccupied operation, power failure.
- 3.** Operations and maintenance training is also to be commissioned. Observation and documentation of this process can help to insure that the training is complete and effective. This documentation is required when

training new employees, for maintenance or operations that happen infrequently or during re-commissioning. The following items should be included in the process:

- a. Verification and documentation of the scope of training provided.
- b. Training includes instructional material and demonstration of operation.
- c. The client agency must insure that the responsible staff attend and take part in the training and demonstration sessions.
- d. Training and operations manuals must be available for the training sessions.
- e. The instructional portion of the training program must cover at least the following:
  - 1) The design intent of each building system, including theory of operation, capabilities and limitations, and modes of control and sequences of operation in the subject building.
  - 2) Use of the operations and maintenance manual.
  - 3) Use of the systems and energy management manual.
  - 4) Review of control drawings and schematics.
  - 5) Procedures for start-up, shutdown, seasonal changeover, normal operation, unoccupied operation, and manual operation.
  - 6) Controls set-up and programming.
  - 7) Troubleshooting.
  - 8) Alarms.
  - 9) Interactions with other systems.
  - 10) Operational monitoring and record keeping, including what should be monitored, what useful information can come from monitored data, and why that information is important to analyzing system operation.
  - 11) Adjustments and optimizing methods for energy conservation.
  - 12) Relevant health and safety issues.
  - 13) Inspection, service, and maintenance requirements for each system, including any requirements for special skills and knowledge that may best be met by specialized service contractors.
  - 14) Sources for replacement parts/equipment.
  - 15) Tenant interaction issues.
  - 16) Why certain features are environmentally responsive (i.e., save energy, improve indoor air quality [IAQ], reduce toxic materials, reduce waste).
- f. The demonstration portion of the training program must include at least the following:
  - 1) Operation of each system, or typical examples if there are several similar systems in the building.
  - 2) Start-up and shutdown procedures, operation under all specified modes of control and sequences of operation, and the correct procedures under emergency or abnormal conditions.
  - 3) Procedures necessary for effective operational monitoring, as appropriate, but particularly for projects with direct digital control systems incorporating trending and graphing features.

4. Documentation is an important part of the commissioning process and should be integrated into all phases of the project. It is most important to the Commissioning Report, which includes the following items:
  - a. An Executive Summary:
    - 1) The commissioning participants and their respective roles.
    - 2) The Basis of Design including a brief building description.
    - 3) The scope of commissioning and testing.
    - 4) An outline of the testing and verification methods.
  - b. An account of each feature or system commissioned including:
    - 1) The determination of the commissioning authority regarding:
      - a) The adequacy of the equipment.
      - b) Documentation and training (film of training desired).
      - c) All maintenance and operation materials and instruction.
      - d) All PTP deficiencies.
      - e) TAB results.
      - f) FPT results (film of testing desired).
    - 2) All test procedures.
    - 3) A list of outstanding commissioning items scheduled for later testing.
    - 4) Commissioning communications separated by phase (PTP, FPT and post occupancy testing):
      - a) Meeting minutes.
      - b) Progress reports.
      - c) Deficiency lists.
      - d) Site visit reports.
      - e) Findings.
      - f) Unresolved issues.
    - 5) Accounting of changes from initial design or commissioning procedure.
    - 6) Report amendments to include deferred seasonal testing.

## F. Commissioning on an OGS project

1. If commissioning is requested by client or desired to “incorporate significant attributes of green design principles”:
  - a. Determine who will act as the commissioning agent:
    - 1) The commissioning agent is usually a qualified third party, although according to the Green Building Tax Credit (GBTC) Part 638.8(d) “a qualified member of the architecture or engineering firm or company that performs the design may act as the commissioning authority; however, such an individual must not be responsible for any aspect of the project design, or construction management or supervision for the subject building. In addition, reporting of all conditions and findings must be immediate and direct from the commissioning authority to the Client Agency.” See the GBTC 638.8(d).
    - 2) A separate term assignment can be made to hire a qualified consultant to act as the commissioning agent. Cross referencing our current term consultants with the approved commissioning

- agents listed on NYSERDA's website is one means of identifying qualified consultants.
- 3) The agent selected should have expertise and experience in the areas that will be required by the project. The commissioning agent should have familiarity with the systems being considered.
- b. When to hire the commissioning agent:
    - 1) The general rule is to hire a commissioning agent as early in the project as possible. This may require hiring a commissioning agent on a Not to Exceed fee (NTE) basis until the project scope is determined. This may give you the opportunity to change commissioning agents depending on the expertise required.
  - c. The scope of the commissioning required:
    - 1) The scope of commissioning may vary considerably. Commissioning may be limited to compliance with specific client direction, or it might be required if the project is to be LEED certified. On projects where commissioning is required, the scope should be determined by examining the LEED compliance level (fundamental or enhanced) that will be achieved. This will establish the minimum scope of services, but the commissioning team may elect to exceed this minimum level.
    - 2) On projects where commissioning is not required, but is requested, the designers, client representatives, commissioning agent and project conditions should be considered in determining the scope.
  - d. The level of training the facility maintenance staff should receive must be verified by the commissioning agent. The extent of the training should be determined and described in the specification. It will usually include a presentation by the Designers of the Design Intent and Basis of Design, classroom and field training for the facility staff.
  - e. Sample 'Prefunctional Checklists' and 'Functional Test Procedures' must be developed for each system or piece of equipment to receive commissioning. Sample checklists are not to be used during the actual commissioning, but are included to clearly communicate the required detail and level of quality, and to act as a guide in the preparation of the actual checklists. Sample checklists are available for many master specifications. Sample checklists are also available from a number of sources, including Portland Energy Conservation, Inc. at [www.peci.org](http://www.peci.org). Sample checklists should be edited to include only those features included in the project.
  - f. Coordinate with the EIC and Cost Control to ensure that the contractor's approved Detailed Estimate includes a line item for successful completion of project commissioning. Typically commissioning costs average 1-3% of the total contract value, depending on the size of the contract and the extent of commissioning.

## G. Commissioning Specifications

1. Commissioning specifications must be included in the contract documents. Commissioning may be applicable to only some of the contracts. Careful

coordination with technical specifications in those trades and with the front end documents for all trades will be required. Even if one of the contracts will not be involved in the commissioning process, that contractor should be made aware that commissioning will occur on the project.

2. For a contract that includes commissioning, the following specification modifications are required:
  - a. Include section 019100- General Commissioning Requirements. This section specifies the contractor's responsibilities to support the commissioning process. Only those specific requirements that impact on the contractor should be included in this section, with the goal of simplifying the process of bid preparation on the part of potential bidders.
  - b. Technical specifications- each system or piece of equipment to be commissioned shall be modified as follows:
    - 1) Reference section 019100- General Commissioning Requirements, as related work specified elsewhere.
    - 2) Modify the 'Submittals' section to include submission of the 'Prefunctional Checklist' and the 'Functional Test Procedures'.
    - 3) If a company field advisor is required to support the commissioning of the specific equipment or system, include the required number of hours.
    - 4) Provide a sample 'Prefunctional Checklist' and 'Functional Test Procedure' for each system or piece of equipment to be commissioned.
  - c. Include the General Commissioning Process description in the Appendix. This section describes the scope and details of the commissioning process, as well as outlining the roles and responsibilities of each member of the commissioning team.
3. Coordination required:
  - a. Section 011000 - Add a paragraph to alert all contracts that commissioning will be part of the project, identifying the commissioning parties and provide the name and address of the commissioning agent.
  - b. Section 013300 - Add language to let contractor know to provide an additional submittal for the commissioning agent for all equipment subject to commissioning.
  - c. Section 017716 - Add submittals of items which need to be included in the commissioning report including warranties, operating instructions and include desired format (paper or electronic or paper, .tif, .pdf etc.).

End of Commissioning Guide